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Annis et al.

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(54) **LATCH ASSEMBLIES FOR CONNECTOR SYSTEMS**

(71) Applicant: **Tyco Electronics Corporation**, Berwyn, PA (US)

(72) Inventors: **Kyle Gary Annis**, Hummelstown, PA (US); **Kevin Michael Thackston**, York, PA (US); **Matthew Richard McAlonis**, Elizabethtown, PA (US); **Albert Tsang**, Harrisburg, PA (US); **Dustin Carson Belack**, Hummelstown, PA (US); **Nicholas Paul Ruffini**, York, PA (US); **Chong Hun Yi**, Mechanicsburg, PA (US)

(73) Assignee: **TYCO ELECTRONICS CORPORATION**, Berwyn, PA (US)

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H01R 13/629	(2006.01)
H01R 13/641	(2006.01)

(52) **U.S. Cl.**

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(58) **Field of Classification Search**

CPC H01R 13/62961; H01R 13/62977; H01R 13/641; H01R 13/62944; H01R 13/62922

USPC 439/157

See application file for complete search history.

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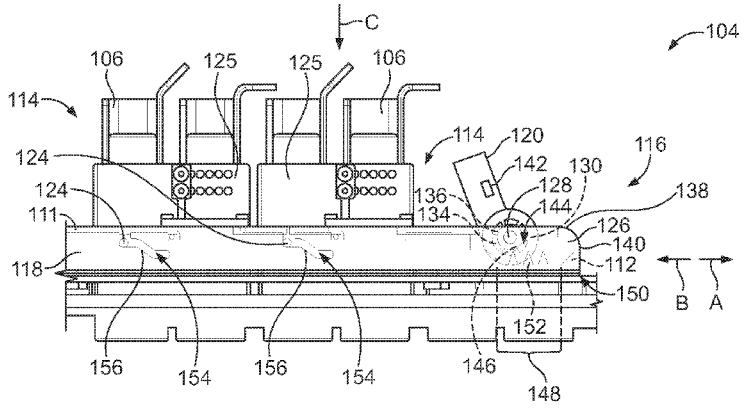
Primary Examiner — Jean F Duverne

(57) **ABSTRACT**

A connector system includes a cavity configured to hold a connector module. The cartridge has a port opening to the cavity. The cartridge removably receives the connector module through the port. The connector system also includes an ejector mechanism. The ejector mechanism has a slider latch movable in a longitudinal direction relative to the cartridge. The slider latch has a profiled groove configured to cam therein. The slider latch has a linear gear. The ejector mechanism includes a rotatable handle having a circular gear configured to engage the linear gear to cause the slider latch to move as the rotatable handle is rotated between a closed position and an open position. The profiled groove engages the cam to secure the connector module to the connector assembly when the rotatable handle is in the closed position and unlock the connector module when in the open position.

20 Claims, 4 Drawing Sheets



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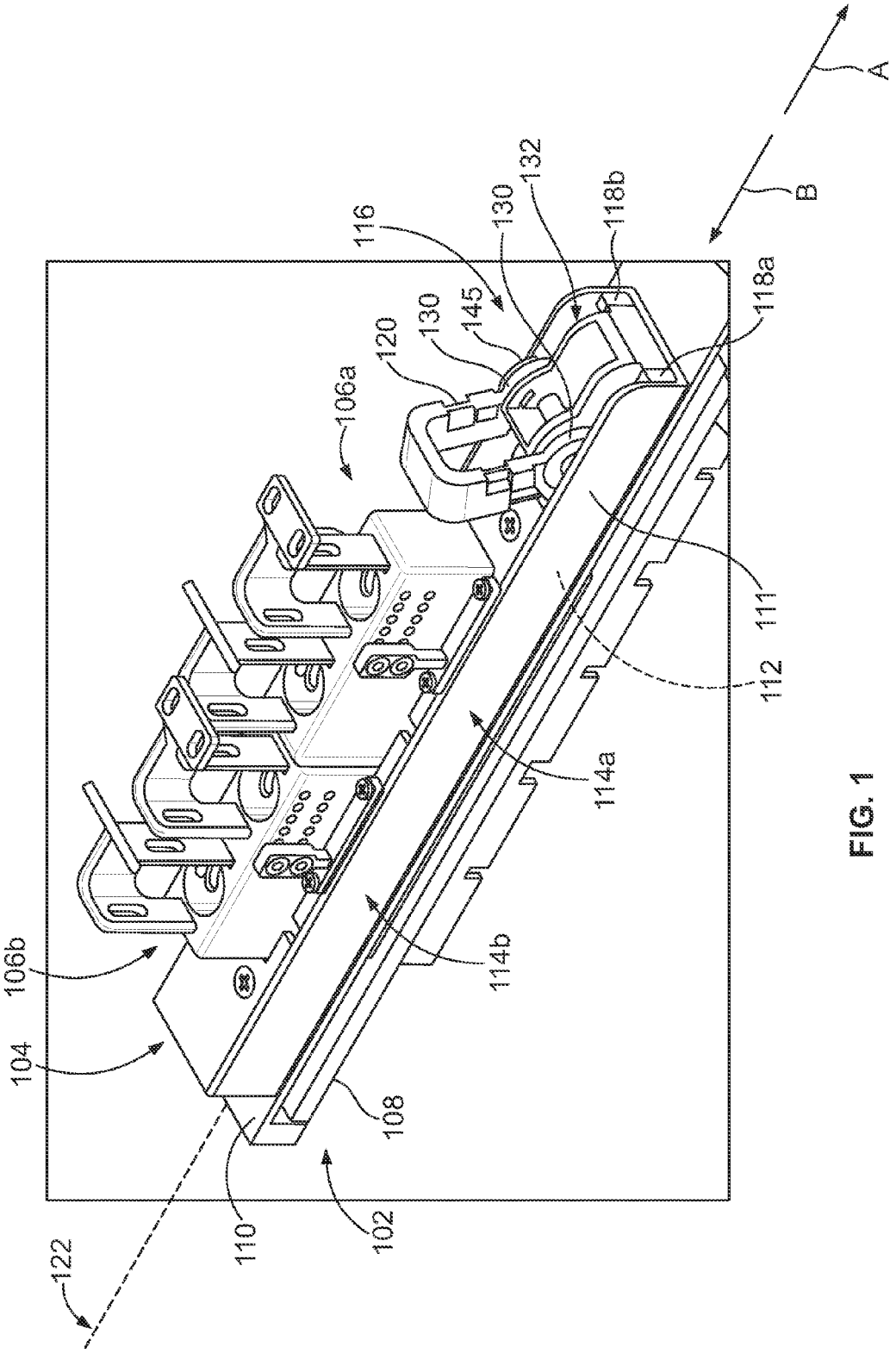
A
B
116
130
132
118b
118a
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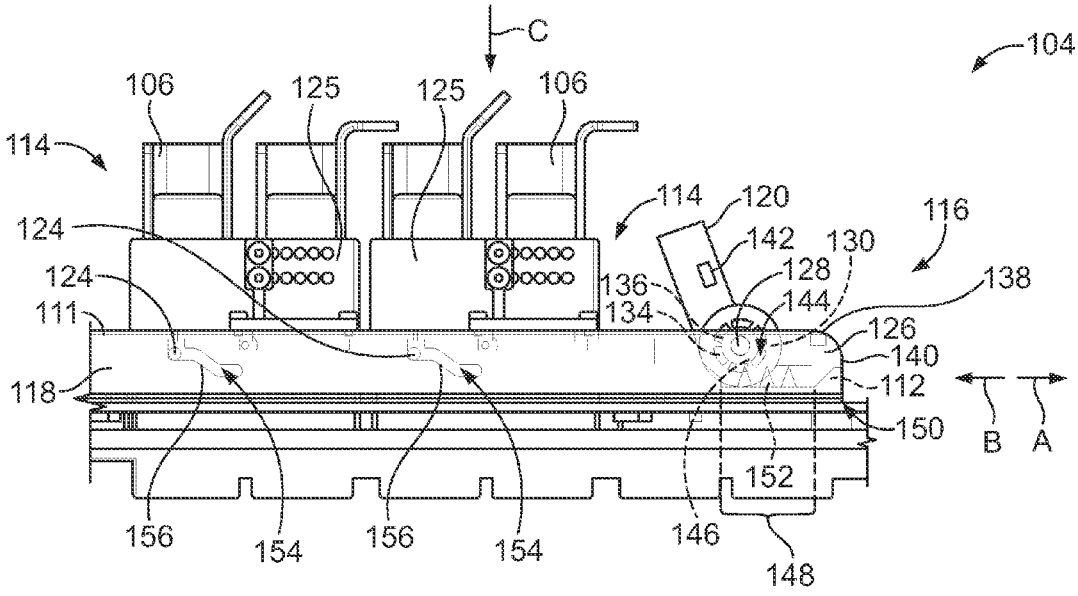
145
120
106a
111
112
114a
114b
106b
104
108
110
102
122

FIG. 1


C
104
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114
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124
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124
128
138
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118
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152
156
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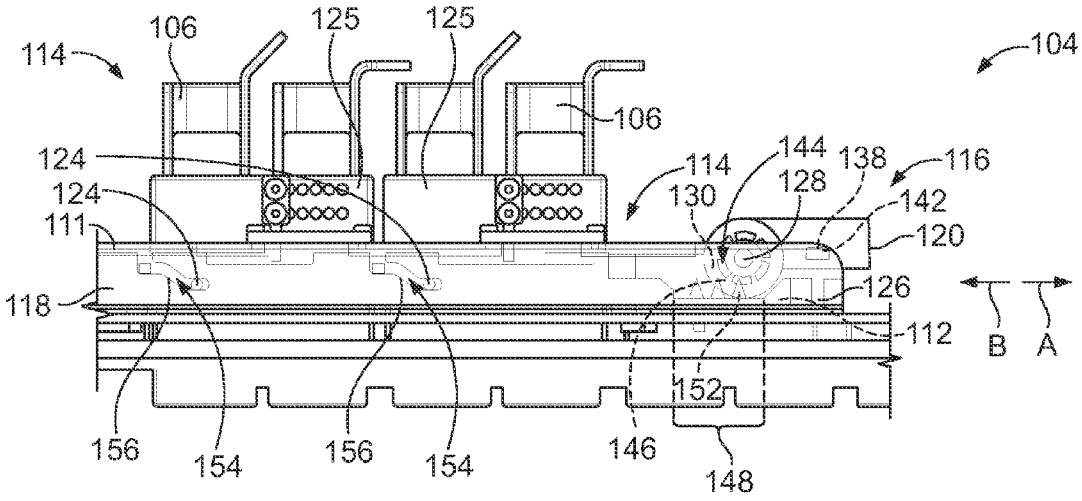
146
148

FIG. 2


104
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138
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142
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156
154
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154
146
148

FIG. 3

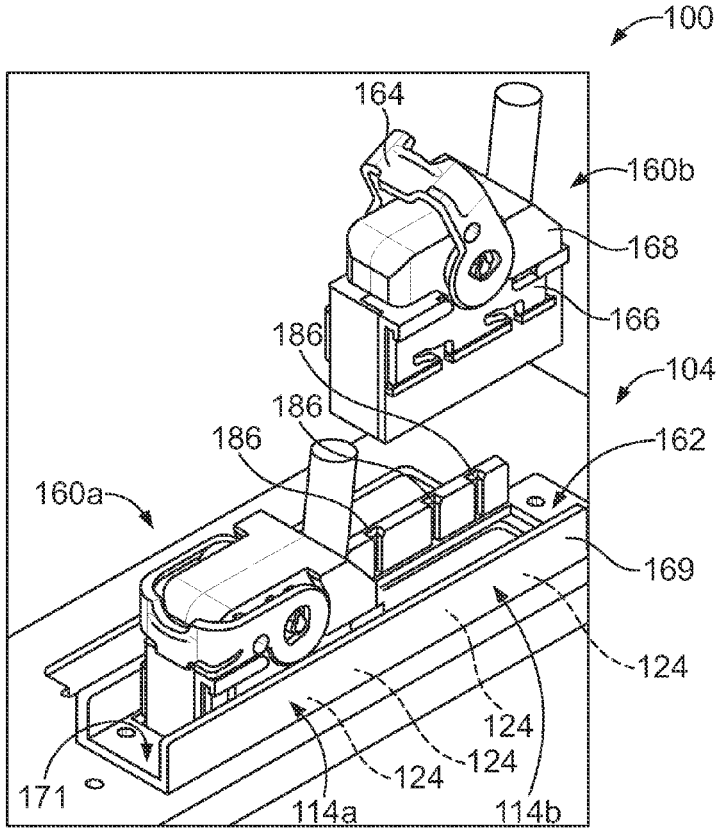

FIG. 4

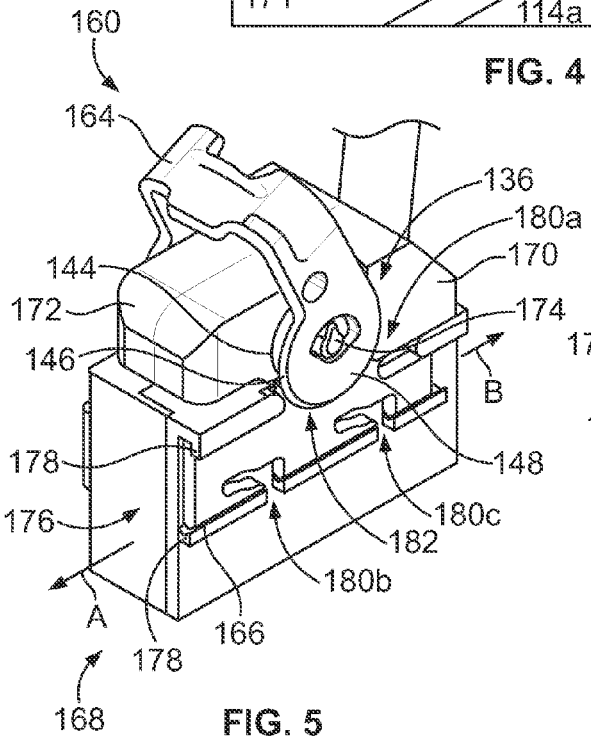

FIG. 5

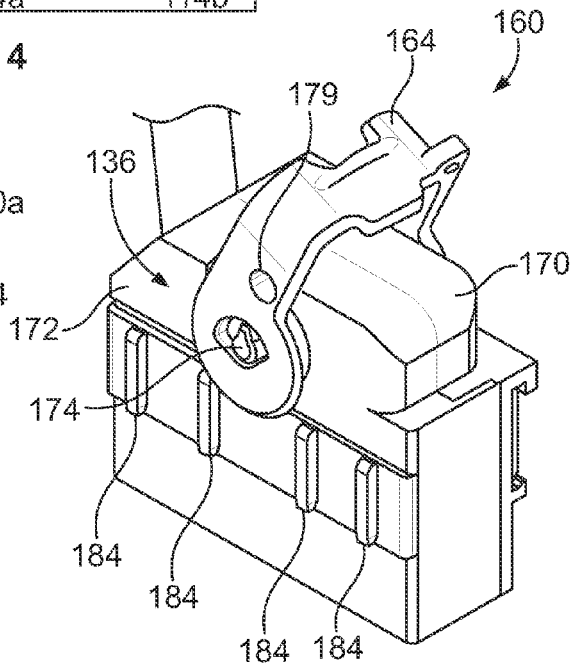

FIG. 6

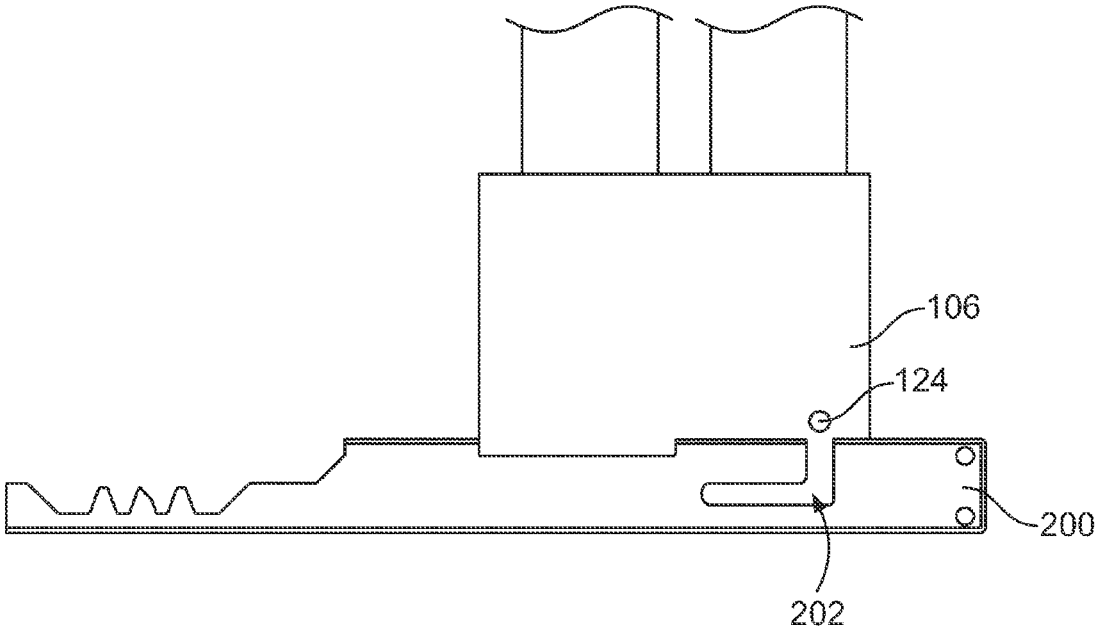

FIG. 7

LATCH ASSEMBLIES FOR CONNECTOR SYSTEMS

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 61/996,784 filed May 14, 2014 having the same title, the subject matter of which is herein incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

The subject matter herein relates generally to latch assemblies for connector systems.

Connector systems typically include electrical connectors and mating electrical connectors configured to be mated with corresponding electrical connectors. In some applications, the electrical connectors are part of a backplane. The electrical connectors are coupled to the backplane and positioned for mating with the mating electrical connectors. The electrical connectors may be mounted to the backplane.

Current retention methods include designs with screws that secure the electrical connectors to the backplane. Such retention methods require tools to assemble and unassembled, which is time consuming. Also, loosening of the screws due to vibration is another potential problem.

A need remains for a mechanism to retain an electrical connector to a surface in such a way to create a simple interface. A need remains for a tool-less means of attaching electrical connectors to a backplane.

BRIEF DESCRIPTION OF THE INVENTION

In one embodiment, a connector system is provided including a cartridge having a cavity configured to hold a connector module therein. The cartridge has a port opening to the cavity. The cartridge removably receives the connector module through the port. The connector system also includes an ejector mechanism. The elector mechanism has a slider latch movable in a longitudinal direction relative to the cartridge. The slider latch has a profiled groove configured to receive a cam therein. The slider latch has a linear gear extending along a portion thereof. The ejector mechanism includes a rotatable handle having a circular gear configured to engage the linear gear of the slider latch to cause the slider latch to move as the rotatable handle is rotated between a closed position and an open position. The profiled groove engages the cam to secure the connector module to the connector assembly when the rotatable handle is in the closed position and unlock the connector module when in the open position.

In another embodiment, a connector system is provided having a cartridge having a cavity configured to hold a connector module therein. The cartridge has a port opening to the cavity. The cartridge removably receives the connector module through the port. The cartridge has a housing having a cam therein. The connector system includes an ejector mechanism. The ejector mechanism includes a slider latch held by the connector module. The slider latch is movable in a longitudinal direction relative to the cartridge. The slider latch has a profiled groove configured to receive the cam. The slider latch has a linear gear extending along a portion thereof. The ejector mechanism also has a rotatable handle held by the connector module. The rotatable handle has a circular gear circumferentially surrounding a portion of a pivot axle. The circular gear is configured to engage the linear gear of the slider latch to cause the slider latch to move as the rotatable handle is rotated between a closed position and an open position. The profiled groove engages the cam to secure the connector module to the connector assembly when the rotatable handle is in the closed position and unlock the connector module from the cartridge when the rotatable handle is in the open position.

In another embodiment, a connector system is provided having a cartridge having a cavity configured to hold a connector module therein. The cartridge has a port opening to the cavity. The connector module has a housing having a cam extending therefrom. The connector system includes an ejector mechanism. The ejector mechanism includes a slider latch housed within the cavity of the cartridge. The slider latch is movable in a longitudinal direction relative to the cartridge. The slider latch has a profiled groove configured to receive the cam. The slider latch has a linear gear extending along a portion thereof. The ejector mechanism includes a rotatable handle held by the cartridge. The rotatable handle has a circular gear circumferentially surrounding a portion of a pivot axle. The circular gear is configured to engage the linear gear of the slider latch to cause the slider latch to move as the rotatable handle is rotated between a closed position and an open position. The profiled groove engages the cam to secure the connector module to the cartridge when the rotatable handle is in the closed position and unlock the connector module from the cartridge when the rotatable handle is in the open position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front perspective view of a connector system formed in accordance with an embodiment.

FIG. **2** is a side cross-sectional view of a cartridge with a rotatable handle in the open position formed in accordance with an embodiment.

FIG. **3** is a side cross-sectional view of a cartridge with a rotatable handle in the closed position formed in accordance with an embodiment.

FIG. **4** is a front perspective view of an embodiment of a connector system having an ejector mechanism with individually releasable connector modules formed in accordance with an embodiment.

FIG. **5** is a front perspective of a connector module formed in accordance with an embodiment.

FIG. **6** is a back perspective view of a connector module formed in accordance with an embodiment.

FIG. **7** is a side view of the connector module in accordance with an exemplary embodiment.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** is a front perspective view of a connector system **100** formed in accordance with an exemplary embodiment. The connector system **100** includes a backplane **102** having a cartridge **104** mounted thereto. The cartridge **104** is configured to hold at least one connector module **106** therein. The illustrated embodiment includes connector modules **106***a* and **106***b*, however other embodiments may include more or fewer connector modules **106**. The connector modules **106** are configured to be electrically connected to corresponding mating electrical connectors (not shown) in the backplane **102** as part of a network system, or other type of system. For example, the mating electrical connectors may be part of a printed circuit board (PCB) or a daughter card **108** that is made into the backplane **102**.

The cartridge **104** is coupled to the backplane **102** and is used to couple the connector modules **106** to the backplane **102**. The cartridge **104** may be coupled to the backplane **102** using fasteners (not shown) that extend into and/or through openings (not shown) in the backplane **102**. The backplane **102** may include a stiffener **110** between the PCB **108** and the cartridge **104** to structurally support the cartridge **104**.

The connector modules **106** may be any type of connectors. The connector modules **106** may include a plurality of contacts or terminals that are configured to be mated to corresponding contacts or terminals of the mating electrical connectors. The contacts or terminals may be terminated directly to the PCB **108** of the backplane **102**, such as by surface mounting or through hole mounting to the backplane **102**. Alternatively, the contacts or terminals may be terminated to ends of wires of the cables of the cable mounted electrical connectors. The contacts of terminals may be any types of contacts or terminals, such as pins, sockets, blades, tuning forks, plugs, receptacles, and the like. The electrical connectors may be fiber optic connectors in alternative embodiments.

The cartridge **104** includes a housing **111** defining at least one cavity **112** therein configured to hold the connector modules **106** therein. The cavity **112** includes at least one port **114** sized and shaped to receive one of the connector modules **106**. In the illustrated embodiment, the cavity **112** has two ports **114***a* and **114***b* each holding the corresponding connector module **106***a* and **106***b*, respectively therein. In other embodiments, the cavity **112** may include more or fewer ports **114**.

The connector system **100** includes an ejector mechanism **116** configured to couple the connector modules **106** to the cartridge **104** and uncouple the connector modules **106** form the cartridge **104**. In an exemplary embodiment, the ejector mechanism **116** may eject the connector modules **106** from the cartridge **104**; however in other embodiments, rather than ejecting the connector module **106** from the cartridge **104**, the ejector mechanism may eject a locking feature from a locked position to an unlocked position, thus allowing the connector modules **106** to be removed by hand. The ejector mechanism **116** includes one or more slider latches **118** operably coupled to a rotatable handle **120**. The slider latches **118** interact with cams **124** (shown in FIGS. **2** and **3**) to cause the connector module **106** to move into, and out of the ports **114**. In the illustrated embodiment, the ejector mechanism **116** includes the slider latches **118***a* and **118***b* engaging opposite sides of the rotatable handle **120**.

The rotatable handle **120** is axially movable between a closed and an open position. When the rotatable handle **120** is moved to the closed position, the cams **124** and the slider latches **118** interact to pull the connector modules **106** into the cavity **112** to electrically and mechanically couple the connector modules **106** to the corresponding mating electrical connectors (not shown) on the PCB **108**. When the rotatable handle **120** is in the closed position, the connector modules **106** may be locked in the cartridge **104**. When the rotatable handle **120** is moved to the open position, the cams **122** and the slider latches **118** unlock the connector modules **106** from the cartridge **104** and may eject the connector modules **106** from the cartridge **104**.

The rotatable handle **120** is coupled to the slider latches **118** such that rotation of the rotatable handle **120** causes the slider latches **118** to translate linearly in a longitudinal direction relative to the cartridge **104**. The slider latches **118** are movable in the longitudinal direction indicated by the arrows A and B generally parallel to a longitudinal axis **122** of the cartridge **104**. In the illustrated embodiment, the ejector mechanism **116** includes the slider latches **118***a* and **118***b* on opposite sides of the rotatable handle **120**. The slider latch **118***a* may also be referred to as a first slider latch, and the slider latch **118***b* may be referred to as a second slider latch. Also as illustrated, the slider latches **118** (also shown in FIG. **2**) are housed within the cavity **112** of the cartridge **104**. But in other embodiments, other arrangements are possible.

In an exemplary embodiment, the cartridge **104** allows for quick connection and quick disconnection of the connector modules **106** from the backplane **102**. For example, the cartridge **104** may disengage or eject one or more of the connector modules **106** held in each of the ports **114** at the same time. As such, the connector modules **106** are capable of being coupled to the cartridge **104** without the use of threaded fasteners or other types of connectors or fasteners that are time consuming to attach and detach.

FIG. **2** is a side cross-sectional view of the cartridge **104** with the rotatable handle **120** in the open position. FIG. **3** is a side cross-sectional view of the cartridge **104** with the rotatable handle **120** in the closed position. In the illustrated embodiment, the slider latch **118** and the rotatable handle **120** are held by the housing **111**, and the cams **124** are positioned on a housing **125** of each connector module **106**. However, in other embodiments, other arrangements are possible.

The connector modules **106** are inserted into the ports **114** (also shown in FIG. **1**) in a mating direction indicated by the arrow C (shown in FIG. **2**). In certain embodiments, the cartridge **104** and/or the connector modules **106** may include features to polarize the connector modules **106** such that the connector modules **106** may be loaded into select ports **114** in select orientations. For example, the connector module **106** may include one or more harness keys configured pass through a keyway in the cartridge **104** to allow the connector module **106** to be received in select ports **114**. Additionally or optionally, the housing **125** may include a second cam (not shown) on a second side of the housing **125**. The second cam may be received by the second slider latch **118***b* (shown in FIG. **1**).

The ejector mechanism **116** may include a base mount **126** held within the cavity **112** of the cartridge **104**. The rotatable handle **120** (also shown in perspective view in FIG. **1**) is rotatably coupled to the base mount **126** via a pivot axle **128**. The base mount **126** includes flanges **130** (also shown in FIG. **1**) along opposite sides of a center channel **132** (shown in FIG. **1**). The pivot axle **128** is coupled to the both of the flanges **130** and spans the center channel **132**. In the illustrated embodiment, the flanges **130** include an opening **134** therethrough. The rotatable handle **120** includes an opening **136** therethrough. The pivot axle **128** passes to and through the openings **134** and **136** to allow rotatable handle **120** to be coupled to the base mount **126** while being free to rotate about the pivot axle **128**.

The flanges **130** may include a boss **138** on an outer surface **140**. The rotatable handle **120** may include a detent **142** configured to align with, and engage the boss **138** when the rotatable handle **120** is moved to the closed position (as shown in FIG. **3**). When the boss **138** engages the detent **142**, the detent **142** may create an audible indication (for example, a clicking sound). Other types of indications may be provided when the handle **120** is in the closed position, such as a visual indication. Additionally, an indication may be provided indicating the handle **120** is in the open position. Additionally or optionally, the detent **142** may provide a friction fit with the boss **138**. As such, boss **138** may hold the rotatable handle **120** in the closed position to prevent the

rotatable handle **120** from inadvertently moving, for example, out of the closed position. For example, the boss **138** may prevent movement of the rotatable handle **120** caused by vibration. In other embodiments, other securing means may be used to hold the rotatable handle **120** in the closed position.

The rotatable handle **120** includes at least one circular gear **144** circumferentially surrounding the pivot axle **128**. In the illustrated embodiment, the circular gear **144** surrounds approximately 180° of the pivot axle **128**, but in other embodiments, the circular gear **144** may extend around the entire perimeter of the pivot axle **128**. The circular gear **144** includes a plurality of teeth **146**. The circular gear **144** may be integrally formed with the rotatable handle **120**. In other embodiments, the circular gear **144** may be a separate component that is joined to the rotatable handle **120**. The rotatable handle **120** may include a second circular gear **145** (shown in FIG. **1**) on an opposite side. The second slider latch **118***b* (shown in FIG. **1**) may engage the second circular gear **145** in a similar arrangement.

The slider latch **118** includes a linear gear **148** extending along a portion of a distal end **150** of the slider latch **118**. The linear gear **148** is complementary to the circular gear **144**. The linear gear **148** includes teeth **152** having a pitch and depth compatible with the teeth **146** of the circular gear **144**. The circular gear **144** and the linear gear **148** may mesh such that rotational movement of the rotation handle **120**, and hence the circular gear **144**, causes linear movement of the slider latch **118**. As the rotation handle **120** is rotated from the open position to the closed position, the slider latch **118** is translated in the direction B. The slider latch **118** is in a latched position when the rotation handle **120** is in the closed position. As the rotation handle **120** is rotated from the closed position to the open position, the slider latch **118** is translated in the direction A. The slider latch **118** is in an unlatched position when the rotation handle **120** is in the open position.

The slider latch **118** includes profiled grooves **154**. The profiled grooves **154** each include an inclined surface **156** configured to guide the cams **124** into and out of the cavity **112**. The slider latch **118** latches the connector module **106** within the cartridge **104** by resisting removal of the cams **124** from the corresponding profiled grooves **154**. The slider latch **118** moves in the direction A to eject the cartridge **104** by sliding the cam **124** along the inclined surface **156** to push the cartridge **104** out of the cavity **112**. The slider latch **118** moves in the direction B to load the cartridge **104** by sliding the cam **124** along the inclined surface **156** to pull the cartridge **104** into the cavity **112**.

FIG. **4** is a front perspective view of an embodiment of the connector system **100** having an ejector mechanism **116** with individually releasable connector modules **160**. In the illustrated embodiment, the connector modules **160***a* and **160***b* are configured to be loaded into the ports **114***a* and **114***b*, respectively, of a cartridge **162** one at a time, and are ejected from the cartridge **162** one at a time. A rotatable handle **164** is coupled to each connector module **160** instead of the base mount **126** as shown in FIGS. **2** and **3**. Additionally, the rotatable handle **164** interacts with a slider latch **166** that is slidably attached to a housing **168** of the connector module **160** instead of the housing **169** of the cartridge **162**. The slider latch **166** interacts with cams **124** on the housing **169** of the cartridge **104** instead of on the connector module **106** as shown in FIGS. **2** and **3**. The cams **124** extend from an inside surface **171** in the cavity **112**. As illustrated the connector module **160** is shown with the rotatable handle **164** in the closed positioned. The connector module **160***b* is shown with the rotatable handle **164** in the open position.

FIG. **5** is a front perspective of the connector module **160**. FIG. **6** is a back perspective view of the connector module **160**.

The housing **168** includes a top shell **170** and a bottom shell **172**. The rotatable handle **164** straddles the housing **168** such that one leg is coupled to the top shell **170** and the other leg is coupled to the bottom shell **172**. The top and bottom shells **170**, **172** each include pivot members **174** extending therefrom. The pivot members **174** extend through the openings **136** in the rotatable handle **164** to pivotably couple the rotatable handle **164** to the connector module **160**.

The top shell **170** includes a passage **176** sized and shaped to receive the slider latch **166**. The passage **176** includes flanges **178** extending toward one another across the passage **176** to slidably capture the slider latch **166** therein. The flanges **178** allow the slider latch **166** to translate in the directions A and B, while holding the sider latch **166** against the top shell **170**. The flanges **178** are segmented to allow the cams **124** (shown in FIGS. **7** and **8**) and the circular gear **144** to contact and interact with the slider latch **166**. For example, the flanges **178** includes the gaps **180***a*, **180***b*, and **180***c* opening into the passage **176**.

In the illustrated embodiment, the rotatable handle **164** includes a shield **182** extending around the circular gear **144**. The shield **182** extends around the circular gear **144** such that the shield extends radially outward beyond the teeth **146**. The shield is configured to prevent foreign objects and/or debris from fouling the circular gear **144** and the linear gear **148**.

The rotatable handle **164** may also include a detent **179** configured to align with and engage a boss **181** on the top shell **170** and/or the bottom shell **172**. The boss **181** engages the detent **179** when the rotatable handle **164** is moved to the closed position. When the boss **181** engages the detent **179**, the detent **179** may create an audible indication (for example, a clicking sound). Additionally or optionally, the detent **179** may provide a friction fit with the boss **181**. As such the boss **181** may hold the rotatable handle **164** in the closed position.

The bottom shell **172** includes keys **184** configured to polarize the connector module **160**. The keys **184** are received in slots **186** (shown in FIG. **4**) on the housing **169** of the cartridge **162** when the connector module **160** is loaded into the cartridge **162**. The keys **184** prevent the connector module **160** from being inserted in an orientation such that the keys **184** are not aligned with the slots **186**. In the illustrated embodiment, only the bottom shell **172** includes the keys **184**. However, in other embodiments, the top shell **170** may include keys **184** that are offset from the keys **184** on the bottom shell **172**. Optionally, the keys **184** may be removable or reconfigurable to define different keying arrangements. The keys **184** may provide guidance during mating and may include lead-ins to assist mating.

It is to be understood that the above description is intended to be illustrative, and not restrictive. For example, the above-described embodiments (and/or aspects thereof) may be used in combination with each other. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from its scope. Dimensions, types of materials, orientations of the various components, and the number and positions of the various components described herein are intended to define parameters of certain embodiments, and are by no means limiting and are merely exemplary embodi-

ments. Many other embodiments and modifications within the spirit and scope of the claims will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. In the appended claims, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein." Moreover, in the following claims, the terms "first," "second," and "third," etc. are used merely as labels, and are not intended to impose numerical requirements on their objects. Further, the limitations of the following claims are not written in means—plus-function format and are not intended to be interpreted based on 35 U.S.C. §112(f) unless and until such claim limitations expressly use the phrase "means for" followed by a statement of function void of further structure.

What is claimed is:

1. A connector system comprising:

a cartridge having a cavity configured to hold a connector module therein, the cartridge having a port opening to the cavity, the cartridge removably receiving the connector module through the port;

an ejector mechanism having:

a slider latch being movable in a longitudinal direction relative to the cartridge, the slider latch having a profiled groove configured to receive a cam therein, the slider latch having a linear gear extending along a portion thereof; and

a rotatable handle having a circular gear circumferentially surrounding a portion of a pivot axle, the circular gear configured to engage the linear gear of the slider latch to cause the slider latch to move as the rotatable handle is rotated between a closed position and an open position;

wherein the profiled groove engages the cam to secure the connector module to the connector assembly when the rotatable handle is in the closed position and unlock the connector module from the cartridge when the rotatable handle is in the open position.

2. The connector system of claim **1**, wherein the rotatable handle causes the slider latch to move to a latched position when the rotatable handle is moved to the closed position, and the rotatable handle causes the slider latch to move to an unlatched position when the rotatable handle is moved to the open position.

3. The connector system of claim **1**, wherein the slider latch and the rotatable handle are housed within the cartridge, and the cam is positioned on a housing of the connector module.

4. The connector system of claim **1**, wherein the slider latch and the rotatable handle are held by the connector module and the cam is positioned on a housing of the cartridge.

5. The connector system of claim **1**, wherein the circular gear on the rotatable handle defines a first circular gear, the slider latch defines a first slider latch, the rotatable handle having a second circular gear on an opposite side of the rotatable handle, the connector system having a second slider latch configured to engage the second circular gear.

6. The connector system of claim **1**, wherein the connector module includes keys configured to polarize the connector module such that the keys interact with slots on a housing of the cartridge.

7. The connector system of claim **1**, wherein the rotatable handle produces an indication when the rotatable handle is moved to the closed position.

8. The connector system of claim **1**, wherein the circular gear includes a plurality of teeth extending radially outward from the pivot axle, the rotatable handle including a shield extending around the circular gear such that the shield extends radially outward beyond the teeth.

9. The connector system of claim **1**, wherein the slider latch is configured to eject the connector module from the cartridge when the rotatable handle is moved to the open position.

10. A connector system comprising:

a cartridge having a cavity configured to hold a connector module therein, the cartridge having a port opening to the cavity, the cartridge removably receiving the connector module through the port, the cartridge having a housing having a cam therein;

an ejector mechanism having:

a slider latch held by the connector module, the slider latch being movable in a longitudinal direction relative to the cartridge, the slider latch having a profiled groove configured to receive the cam, the slider latch having a linear gear extending along a portion thereof; and

a rotatable handle held by the connector module, the rotatable handle having a circular gear circumferentially surrounding a portion of a pivot axle, the circular gear configured to engage the linear gear of the slider latch to cause the slider latch to move as the rotatable handle is rotated between a closed position and an open position;

wherein the profiled groove engages the cam to secure the connector module to the connector assembly when the rotatable handle is in the closed position and unlock the connector module from the cartridge when the rotatable handle is in the open position.

11. The connector system of claim **10**, wherein the rotatable handle causes the slider latch to move to a latched position when the rotatable handle is moved to the closed position and the rotatable handle causes the slider latch to move to an unlatched position when the rotatable handle is moved to the open position.

12. The connector system of claim **10**, wherein the connector module includes keys configured to polarize the connector module such that the keys interact with slots on a housing of the cartridge.

13. The connector system of claim **10**, wherein the slider latch is configured to eject the connector module from the cartridge when the rotatable handle is moved to the open position.

14. The connector system of claim **10**, wherein the gear portion includes a plurality of teeth extending radially outward from the pivot axle, the rotatable handle including a shield extending around the geared portion such that the shield extends radially outward beyond the teeth.

15. A connector system comprising:

a cartridge having a cavity configured to hold a connector module therein, the cartridge having a port opening to the cavity, the connector module having a housing having a cam extending therefrom, the cartridge removably receiving the connector module through the port;

an ejector mechanism having:

a slider latch housed within the cavity of the cartridge, the slider latch being movable in a longitudinal direction relative to the cartridge, the slider latch having a profiled groove configured to receive the cam, the slider latch having a linear gear extending along a portion thereof; and

a rotatable handle held by the cartridge, the rotatable handle having a circular gear circumferentially surrounding a portion of a pivot axle, the circular gear configured to engage the linear gear of the slider latch to cause the slider latch to move as the rotatable handle is rotated between a closed position and an open position;

wherein the profiled groove engages the cam to secure the connector module to the cartridge when the rotatable handle is in the closed position and unlock the connector module from the cartridge when the rotatable handle is in the open position.

16. The connector system of claim **15**, wherein the rotatable handle causes the slider latch to move to a latched position when the rotatable handle is moved to the closed position, and the rotatable handle causes the slider latch to move to an unlatched position when the rotatable handle is moved to the open position.

17. The connector system of claim **15**, wherein the connector module includes keys configured to polarize the connector module such that the keys interact with slots on a housing of the cartridge.

18. The connector system of claim **15**, wherein the geared portion on the rotatable handle defines a first geared portion, the slider latch defines a first slider latch, the rotatable handle having a second geared portion on an opposite side of the rotatable handle, the connector system having a second slider latch configured to engage the second geared portion.

19. The connector system of claim **15**, wherein the slider latch is configured to eject the connector module from the cartridge when the rotatable handle is moved to the open position.

20. The connector system of claim **15**, wherein the rotatable handle produces an indication when the rotatable handle is moved to the closed position.

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